(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 325 356 A3**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **89300214.7**

(51) Int. Cl.5: **F23N 1/00**

(22) Date of filing: **11.01.89**

(30) Priority: **21.01.88 US 146501**

(43) Date of publication of application:
26.07.89 Bulletin 89/30

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(88) Date of deferred publication of the search report:
18.07.90 Bulletin 90/29

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(54) Multiple fuel burner control system.

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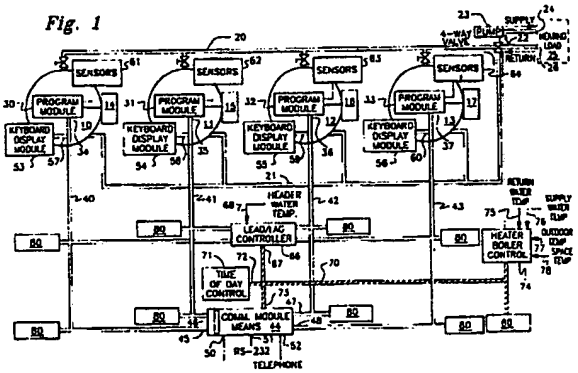
Fig. 1



EP 0 325 356 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 0214

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	WO-A-8400624 (JOHNSON SERVICE COMPANY) * page 6, line 13 - page 16, line 36 * * page 18, line 32 - page 22, line 2 * * page 27, line 11 - page 33, line 10; figures 1-4, 8 *	1, 2, 4-6	F23N1/00
A	MICROPROCESSORS AND MICROSYSTEMS. vol. 9, no. 2, March 1985, LONDON GB pages 64 - 70; Stuart Pegler: "Gas burner control using microprocessors" * pages 67 - 69; figures 4-7 *	1, 3	
A	IEEE TRANSACTIONS ON ENERGY CONVERSION. vol. EC-2, no. 2, June 1987, NEW YORK US pages 222 - 226; W. R. Urrea: "Modernization of a burner control system in a thermoelectric power plant using logic programmable controllers" * pages 223 - 225; figures 1-3 *	1	
A	FR-A-2565714 (CIAC)		TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			F23N G05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03 MAY 1990	KOOIJMAN F.G.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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EPO FORM 1503 03.82 (P0401)

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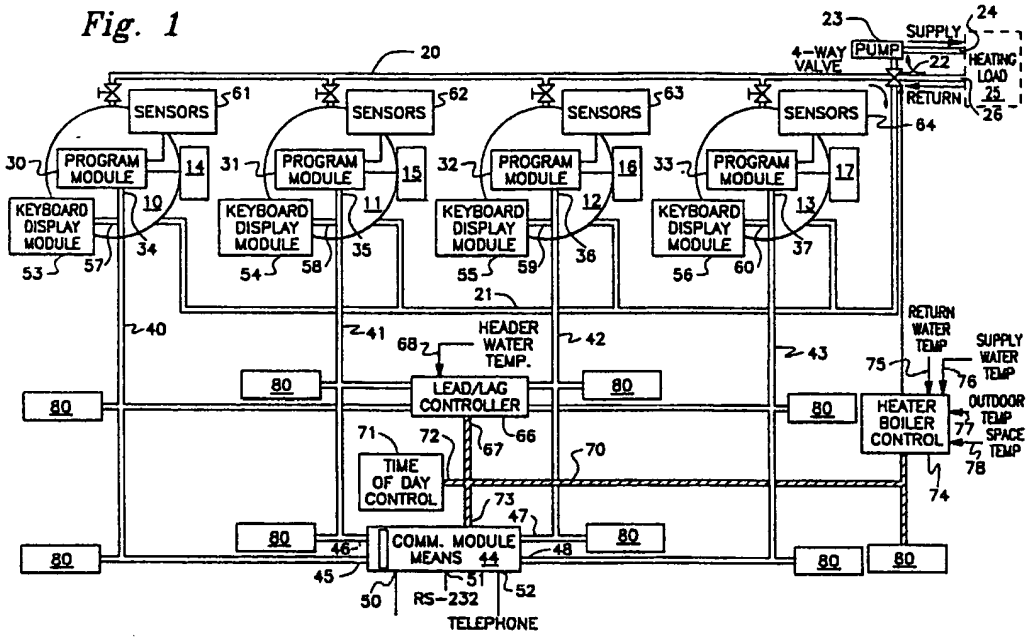
Fig. 1


20
23
SUPPLY
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PUMP
4-WAY VALVE
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HEATING LOAD
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RETURN
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SENSORS
61
62
63
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PROGRAM MODULE
14
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17
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KEYBOARD DISPLAY MODULE
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21
40
41
42
43
HEADER WATER TEMP.
68
RETURN WATER TEMP
75
SUPPLY WATER TEMP
76
80
LEAD/LAG CONTROLLER
66
67
HEATER BOILER CONTROL
OUTDOOR TEMP
77
SPACE TEMP
78
74
71
72
TIME OF DAY CONTROL
70
73
47
COMM. MODULE MEANS 44
46
48
45
50
51
52
RS-232
TELEPHONE

MULTIPLE FUEL BURNER CONTROL SYSTEM

BACKGROUND OF THE INVENTION

The control of fuel burners for non-residential applications typically have been accomplished by electromechanical programmers referred to as flame safeguard programmers. These programmers operated a number of relays, switches, and associated equipment in response to a motor driven cam arrangement. These pieces of equipment were rather rigid in their application, and required that a correct model of the flame safeguard programmer be selected for each individual application.

Microcomputers have now been introduced as a way of improving the intelligence and flexibility of flame safeguard programmers. Single burner flame safeguard programmers have been introduced and the BC7000 "Blue Chip" Microcomputer Burner Control System as sold by Honeywell allows for many functions not available in earlier electromechanical flame safeguard programmers. The BC7000 added safety check logic, annunciation and self-diagnosis, and energy saving innovations. Once again, this particular type of unit has been applicable to a single burner installation.

SUMMARY OF THE INVENTION

Now that microcomputers have been established as a safe way to control fuel burners, it is possible to take advantage of their continued increase in intelligence at a low cost to build multiple boiler-burner controls that can be interconnected and dealt with either remotely or on site. The term multiple burner controls will be used as a generic term regardless of the number of burners or boilers that are involved. In the present invention a plurality of individual burner control systems are provided each with a first level of data bus connections to a communications interface. This allows the communications interface to provide information to each of the individual controls, and to further provide an output to remote locations via connections such as a local area network, RS-232 cables, or to a telephone line.

The interchange of information by way of the structure of the present invention is not limited to the use of a communications interface with the individual burner controls for two-way flow of data or control. The present invention encompasses a second data bus connected to the communications interface that is capable of connecting to additional control equipment. The two data buses which connect to the communications interface are designed so that there cannot be a cross flow of information between the various burner control systems, nor can the secondary or additional data bus which has been added be used to alter or control safety critical functions in any of the individual burner control units. The burner control units have been specifically identified as program modules, and that term will generally be used in the subsequent discussion of this invention. By providing two different types of data buses, which are exclusive of one another in their data carrying capacities, it is possible to build a system wherein the program modules can be used on individual boiler-burners, but that information cannot cross flow between the various program modules. Further, with the data bus structure disclosed, input and output data is capable of being transmitted by the communications interface. The communications interface is provided with additional data or information from other controls, but this data is limited so that no safety related activity can be altered thereby guaranteeing the integrity and safety of the overall control system.

In accordance with the present invention, a system for interconnecting a plurality of fuel burners for control and output of information for said fuel burners including: a plurality of program modules with a single program module adapted to control a single burner; each of said program modules including microcomputer means and further including data bus connection means; a keyboard and display module including data bus connection means; data bus means connecting a first of said program modules to said keyboard and display module to allow input and output data to be communicated to and from said first program module which is adapted to control a first of said fuel burners; said input and output data encompassing a full range of operation of said first fuel burner; communications module means having data bus connection means connected to said data bus means; said data bus means and said program modules restricting some data communications from said communications module means to said program modules; and second data bus means and said data bus connecting means connected to said other data bus connection means and capable of providing communications to and from said first data bus means without allowing said first data bus means to communicate between themselves.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a multiple fuel burner and boiler arrangement with four boilers, and;

Figure 2 is a detailed layout of a single program module with keyboard and display module.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In Figure 1 there is disclosed a block diagram of the novel system. The sytem is shown as made up of four boilers 10, 11, 12, and 13. The boiler 10 has associated with it a fuel burner 14, boiler 11 has a fuel burner 15, boiler 12 has a fuel burner 16, and boiler 13 has a fuel burner 17. Each of the boilers 10-13 are connected to inlet and outlet piping generally disclosed at 20 and 21 as conventional headers. The headers 20 and 21 contain normal valve structures, and are connected through a four-way valve 22 to a pump 23 which supplies heated water or steam to a supply pipe 24. A heating load 25 is shown connected to the supply pipe 24 and to a return pipe 26.

The boiler supplies steam or hot water to the header 20 where it is diverted by the four-way valve 22 through the pump 23 to the supply pipe 24. The heat is then utilized at the heating load 25, and the lower temperature water and/or condensate is returned via return pipe 26. The boilers, fuel burners, headers, pump, etc., are all conventional and have been disclosed merely to provide a system to which the novel fuel burner control system is adapted to be connected.

Four program modules 30, 31, 32, and 33 are disclosed with a single program module associated with each one of the boilers. That is, the program module 30 is associated with boiler 10, while the program module 31 is associated with boiler 11, etc. The program modules are physically located at or near the boilers. The make-up of the program module is disclosed in detail in Figure 2, and will be discussed subsequently.

Each of the program modules 30-33 have individual data bus connection means 34, 35, 36 and 37. The bus connection means are conventional cable and connector arrangements for the data bus means. Each of the data bus connection means 34-37 are connected to data buses 40, 41, 42 and 43 which ultimately connect to a communications module means 44. The communications module means 44 has appropriate data bus connection means 45, 46, 47 and 48. Data bus connection means 45 is connected to data bus means 40, data bus connection means 46 is connected to data bus 41, data bus connection means 47 is connected to data bus 42, and data bus connection means 48 is connected to data bus 43. This arrangement allows each of the program modules to be connected by a first data bus means to the communications module means 44. The communications module means 44 has different types of conventional interconnect arrangements. Three are shown and are a local network connection means disclosed at 50, RS-232 means at 51, and a telephone connection means at 52. These three are only by way of example. This allows the communication module means to interface with computer terminals and telephones as well as other types of remote equipment.

Four keyboard and display modules 53, 54, 55, and 56 are disclosed with data bus connection means 57, 58, 59, and 60. As is apparent from the drawing the data bus connection means 57, 58, 59, and 60 allow connection to the data buses 40, 41, 42, and 43, respectively.

While the disclosure of Figure 1 shows four keyboard and display modules 53-56, a single keyboard and display module could be used and could be removed from one boiler to the next. This is not a recommended form of installation, but would be possible as the keyboard and display modules are interchangeable and can be readily connected or disconnected from the appropriate data bus by the data bus connection means. The main disadvantage of an installation utilizing less than a keyboard and display module for each program module is the lack of the ability to readout continuously data on the state of the boilers by a person in the boiler room. The disadvantage would be further extended to the fact that if changes were needed, the keyboard and display module in one location would have to be physically relocated to accomplish a programming task on an associated boiler.

Each of the program modules 30, 31, 32, and 33 would have associated sensors 61, 62, 63, and 64. The sensors would be wired or connected to the appropriate program module to provide the program module with data on pressures, temperatures, etc., in each of the boilers, as is well known.

The system may be completed by the addition of a lead/lag controller means 66 which is supplied with header water temperature 68 and is capable of supplying that information, along with other information to a data bus connection means 67 to a second data bus means 70. The second data bus means 70 is further connected to a time of day control 71 at a data bus connection means 72, and with the second data bus means 70 it is connected to the communications module means 44 at 73. The second data bus means 70 could also receive information such as information from a heating boiler control means 74. The heating boiler control means 74 receives water return temperature at 75, supply water temperature at 76, outdoor tempera-

ture at 77, and space temperature at 78.

The data bus means 70 is structured so that the communication from the equipment to which it is connected can supply the communications module means 44 with information, but the communications module means 44 prevents an interaction between the data bus means 70 and the balance of the data bus means 40, 41, 42, and 43. Also, the communications module means 44 is structured so that there can be no "cross talk" or interconnection of information with the data buses 40, 41, 42, and 43.

Additional blocks have been shown at 80 for future controls that can be added to this system. The specific types of controls are not material to the present invention and have not been described.

In Figure 2 there is disclosed a program module that can be considered module 30. The program module 30 includes a chassis 30′ which is mounted at any convenient location, and has a plurality of terminals to connect to the equipment normally associated with a fuel burner. The equipment has been specifically identified, and only a few of the most prominent connections will be mentioned herein. A flame sensor is disclosed at 81, while a damper motor is disclosed at 82. The damper motor can be any type of electric motor having a follow-up potentiometer disclosed at 83 and has connections at the damper motor terminals identified at 84.

A step-down transformer is disclosed at 85 to power the damper motor 82 and the keyboard and display module 53. A keyboard and display module 53 is separately identified and connected by bus 40 to the chassis 30′. The chassis 30′ also supports a plug-in flame amplifier 89 of conventional design. The chassis 30′ acts as the basic mounting means for the microprocessor based portion of the program module. The program module 30 includes the necessary microcomputer means 86, and has appropriate connection means to connect the microcomputer means 86 and its associated equipment into the overall boiler system to form the flame safeguard system. This equipment includes modular boards and receiving means 87 and 88. These boards can be connected in any convenient manner to the internal circuits of the program modules 30.

The presently disclosed system of Figure 1 allows for each of the program modules to individually control its associated boiler. Input and output data for each boiler is accomplished through its associated keyboard and display module. This information is also supplied through the first data bus means 40 to the communications module means 44 where the information can be distributed. The separate data bus connections in conjunction with the programming of the program modules prevents cross talk between the various program modules. The addition of the second data bus means 70 allows for input and output information of a non-critical nature through the communications module means 44 without any possibility of there being an interchange of information between the various buses in the system.

A preferred implementation of the present invention has been disclosed in Figures 1 and 2, but is clearly subject to many modifications that would be obvious to one skilled in the art. The applicants wish to be limited in the scope of their invention solely by the scope of the appended claims.

Claims

1. A system for interconnecting a plurality of fuel burners (14-17) for control and output of information for said fuel burners including: a plurality of program modules (30-33) with a single program module adapted to control a single burner; each of said program modules including microcomputer means (86) and further including data bus connection means (34); a keyboard and display module (53) including data bus connection means (57); data bus means (40) connecting a first of said program modules (30) to said keyboard and display module (53) to allow input and output data to be communicated to and from said first program module which is adapted to control a first of said fuel burners (14); said input and output data encompassing a full range of operation of said first fuel burner; communications module means (44) having data bus connection means connected to said data bus means; said data bus means and said program modules restricting some data communications from said communications module means to said program modules; and second data bus means (70) and said data bus connecting means connected to said other data bus connection means and capable of providing communications to and from said first data bus means without allowing said first data bus means to communicate between themselves.

2. A system for interconnecting a plurality of fuel burners as claimed in Claim 1 wherein a keyboard and display module (53-56) is provided for each program module.

3. A system for interconnecting a plurality of fuel burners as claimed in Claim 1 or 2 wherein said communications module means (44) includes further connection means to adapt said communication module means to communicate with input and output communication means (50, 51, 52) which are remote from said fuel burners.

4. A system for interconnecting a plurality of fuel burners as claimed in any one of the preceding claims wherein said first data bus means (40-43) and said program modules (30-33) restrict safety-critical system programming to said keyboard and display modules (53-56) to the exclusion of said communications module means (44).

5. A system for interconnecting a plurality of fuel burners as claimed in any one of the preceeding Claims wherein said program modules (30-33) are modular structures including chassis means 30', plug-in flame amplifier means (89), and modular board receiving means (87-88); said module board receiving means providing connection means to adapt said program modules for operation of different burner systems.

6. A system for interconnecting a plurality of fuel burners as claimed in any one of the preceeding Claims wherein said keyboard and display modules (53-56) each include programming input means, and visual output display means.

7. A system for interconnecting a plurality of fuel burners as claimed in Claim 6 wherein said visual output display means (53) is a liquid crystal alpha-numeric display.

8. A system for interconnecting a plurality of fuel burners as claimed in any one of the preceeding Claims wherein each of said fuel burners (14-17) fires an associated boiler (10-13); said burners and boilers each having limit sensor means (61-64); and said limit sensor means for each of said fuel burners and its associated boiler connected to said program module for said associated fuel burner and boiler for safe control of said fuel burner by operation of said program module.

9. A system for controlling a plurality of fuel burners as claimed in any one of Claims 3 to 8 wherein said further connection means include telephone connection means (52) and computer compatible connection means (50-51).

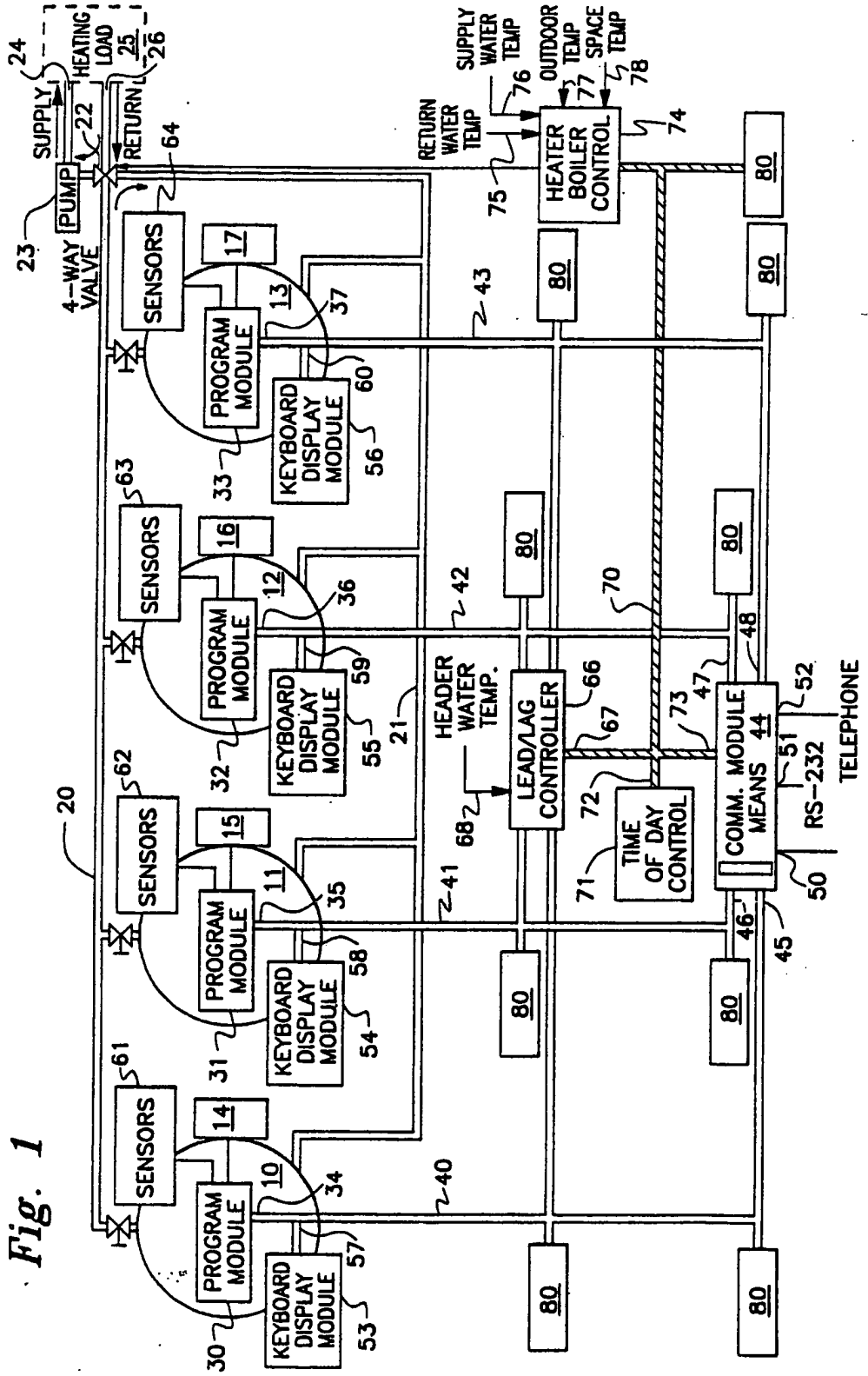
SUPPLY
HEATING LOAD
RETURN
PUMP
4-WAY VALVE
SENSORS
PROGRAM MODULE
KEYBOARD DISPLAY MODULE
RETURN WATER TEMP
SUPPLY WATER TEMP
OUTDOOR TEMP
SPACE TEMP
HEATER BOILER CONTROL
HEADER WATER TEMP.
LEAD/LAG CONTROLLER
TIME OF DAY CONTROL
COMM. MODULE MEANS
RS-232
TELEPHONE
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Fig. 1